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CONTENTS

AN AUTUMN OFFENSIVE

WAR in these days is conducted on so vast a scale that every major operation, whether financial or military, must be planned months in advance. Men and money must be marshalled and munitions manufactured long before the signal is given to open the engagement.

Far behind the lines, in Berlin, Hamburg and other financial centres of Germany, the enemy financiers last winter prepared the Eighth Tyranny Loan, which brought in $3,600,000,000 in money of one sort or another this spring. Today they are getting their people in line for the ninth loan. Since the fall of 1914, the German war loans have been offered regularly at intervals of six months or so. If they work on schedule this time, the Germans will be floating the ninth issue about the time the Government of the United States offers the Fourth Liberty Loan to Americans this autumn. Thus both nations will be tested at the same time and the American dollar will compete with the German mark. But this Government plans the greatest loan of history. It is expected to be twice as much as the Eighth Tyranny Loan and a billion more than Great Britain's victory loan of $5,000,000,000, which is the largest yet floated in any country.

So stupendous an undertaking as the Fourth Liberty Loan requires the most careful planning on the part of every American, of whatever age or condition of bankroll. The time to meet the call of the Fourth Liberty Loan is now, and the way to meet it is by preparing a programme of saving. The Germans are busy right now on their loan. Are you preparing for yours? To be thrifty and forehanded at this time is the task of every American who wishes to take part in Uncle Sam's financial offensive next autumn. To conserve resources, not only of labor and materials but also of credit and cash is to perform a war service of the first magnitude.

Captain O. J. MAY

No doubt many readers of *Lubrication* were personally acquainted with Captain O. J. May, and have consulted with him on matters relating to lubrication during the long period of time that he was connected with The Texas Company. Other readers of this magazine who were not privileged to know Captain May personally are acquainted with him through reading several of his articles which have appeared in this publication. They will no doubt be as greatly shocked to learn of his untimely death as were his associates in The Texas Company.

Following is a reprint of an article which appeared in our house organ, *The Texaco Star*, concerning the death of Captain May.

Captain O. J. May, Signal Corps, U. S. A., died from endocarditis after a brief illness on May 22, 1918, at the Washington Sanitarium, Takoma Park, Washington, D. C. Before Captain May entered the service of the United States Government he was among the foremost lubrication and fuel engineers in the United States. He was a member of the American Society of Mechanical Engineers and of the Society of Automotive Engineers. Although well beyond draft age he resigned a lucrative position accepting a commission as Captain in the Engineers Reserve Corps on June 15, 1917. He was re-commissioned Captain in the Signal Corps, Regular Army (Temporary) on November 15, 1917.

Captain May had full charge of the preliminary experimental work for the preparation of specifications covering lubricating oil for aeronautical engines. This important work he completed after laboratory tests at the Washington Navy Yard where he had charge of a Corps of Army and Navy Engineers. Very important preliminary work was also conducted under his charge at the Altitude Testing Laboratory at the Bureau of Standards.

Captain May had full charge of the lubrication engineers and oil house experts at the various aviation fields and of the engineers in charge of the testing work with lubricants and fuels at the fields and at manufacturing plants.

Captain May was endowed with great energy and reserve force. He labored unceasingly at all hours. For instance, during a series of tests at the Altitude Testing Laboratori- he stood a continuous watch of sixty-five hours without leaving his work. His unflagging zeal was an inspiration to his subordinates. His patriotic devotion to duty cost him his life as certainly as if he had fallen in battle.

As evidence of the Government's appreciation of Captain May's services, he had been recommended for promotion to the rank of Major.

SOME DIFFICULT GEAR LUBRICATING CONDITIONS IN THE CEMENT PLANT

THE amazing increase in the output of Portland Cement in the United States from 42,000 barrels in 1880 to 92,000,000 barrels in 1916, represents a growth that is probably unequaled in any industry. The increasing demand for cement in all forms of construction, including office buildings, hotels, factories, dwellings, docks, bridges, railroads, etc., has caused the construction of enormous plants all over the country for the manufacture of Portland Cement. Inasmuch as the manufacture of Portland Cement requires the use of heavy and expensive machinery, the questions of continuous operation and minimum maintenance costs are very important. The conditions surrounding the manufacture of cement naturally tend to wear out the equipment very rapidly, and any improvements which can be made in the methods of taking care of the equipment will help to cut down operating costs, thereby producing cheaper cement.

Portland Cement is manufactured by two general processes, the wet and dry methods, and while there are of course many individual variations in the kind of equipment used in each of these processes, depending somewhat on the character of the raw material, the general procedure in handling the material is about the same. In the dry process the method of handling the material is essentially as follows:

The rock broken from the quarry is picked up by steam shovels, loaded into dump cars and transferred to the crusher or breaker house, where the rock is roughly crushed by vertical gyratory crushers into pieces about the size of an egg. The crushed rock from the breakers is then screened through rotary screens or agitating screens, the fine material being delivered by elevators to storage bins, and the coarse material to other breakers or crushers which grind the rock still smaller. After the rock is properly crushed it is mixed with clay or shale and then must be thoroughly dried before it can be pulverized. These dryers consist of enormous cylinders ranging from 4 to 8 ft. in diameter and from 30 to 80 ft. in length, set at a slight inclination to the horizontal and revolving two or three revolutions per minute. The raw material is fed in at the upper end and moves gradually to the lower end as the cylinder revolves. Powdered coal, oil or gas enters at the lower end of the dryer and is burned, the heat driving off the moisture from the raw material and thoroughly drying it.

Sometimes the dried material is ground by ball mills or ball tube mills to a rather fine sand which is again pulverized in tube mills or pulverizers to a very fine powder before being burned; other installations complete all the grinding in one pulverizing process. This finely powdered rock is next carried to the kilns and enters at the upper end or flue end of an enormous rotary cylinder slightly inclined, and passes down to the lower end by the combined effect of gravity and the rotation of the kiln. At the same time pulverized coal, oil or gas enters at the lower end and the high temperature resulting from the burning fuel fuses the powdered mixture into clinkers. From the kilns the clinkers are delivered to rotary cylinders, called coolers, through which cool air, and sometimes water, is passed

and the hot clinkers sufficiently cooled to facilitate grinding.

The clinker is broken up in ball tube mills, crushing rolls and pulverizers, a small quantity of gypsum is added and the whole thoroughly ground up together. The ground material is then delivered to finishing tube mills or pulverizers which do the final grinding and the finished product is delivered to the stock houses where it is sacked for marketing.

The wet process differs from the above in that the raw material up to the point where it is delivered to the kilns is very wet, containing from 30 to 50% of water, the mixture being called slurry. Practically the same style of equipment as that used in the dry process is required except that dryers are naturally unnecessary and pumps for handling the slurry have to be installed.

Cement mills are dusty places and every piece of machinery, all the buildings and a goodly portion of the surrounding country is always covered with an ever increasing coat of dust. The dust enters bearings and settles on gear, drying up the lubricant, cutting the gear teeth and scoring bearing surfaces and shafts. The following quotation explains the source of the dust.*

"While a large part of the dust spread over the country comes from the kiln stacks, it does not all come from this source. The dust coming from other sources than the kiln stacks may be classified under several heads, as follows:

"1. Dust arising when dry material is dumped into coarse crushers.

"2. Dust formed during screening of crushed material.

"3. Dust caused by dropping crushed stone on large piles in the open from overhead conveyors.

"4. Dust raised by dumping crushed rock, coal, clinker and similar material into open cars, either from overhead bins or by crane-operated buckets.

"5. Rock, clay and coal dryer stack dust.

"6. Dust from pulverizing and fine grinding.

"7. Dust from elevating and conveying systems.

"8. Dust from dropping cement into bins in the stock houses.

"9. Dust from packing machines.

"10. Dust arising during sorting and counting returned sacks."

The wet process, of course, does not produce anywhere near the quantity of dust arising from plants operated by the dry process.

This dust is the cause of most of the repairs to and replacements of the machinery, and its reduction is receiving the attention of operators and engineers. Bearings can easily be made so as to exclude the greater part of the dust, but gears, as a rule, are not enclosed with dust-proof guards and the cement dust very quickly dries up the lubricant, causing it to wear off and causing bright spots to appear on the gear teeth, actual cutting of the metal soon taking place. Many gears are covered with shields which are perfectly satisfactory as far as protecting the workmen is concerned, but are useless for protecting the gears from dust or for holding the gear lubricant. While there are many places where it is not possible to provide dust-proof guards, wherever it can be done, either by the builder in the original design of the machine or by the operating superintendent after the equipment is installed, such guards will be found advantageous not only from a gear-saving standpoint but also as a safety measure.

From the quarries to the shipping room practically every piece of equipment has one or more gears which require lubrication, and as the

*"The Dust Problem in Cement Mills" by C. H. Sonntag, in *Concrete*, April, 1918.

gear service on many of the machines is quite severe and the operating conditions somewhat different from the ordinary class of machinery, a brief description of the characteristics which a satisfactory gear lubricant must possess may be of assistance in selecting a correct gear lubricant.

Steam Shovels. The immense steam shovels which handle the raw material from the quarries such as limestone, clay, chalk, shale, etc., contain many gears which are subjected to cold and hot weather, rain, mud, dust and grit. The wearing out of bearings and journal brasses throws shafts out of alignment and gears out of perfect mesh, increasing the severity of the demands on the gear lubricant. They receive infrequent attention and on this account the gear lubricant must be able to last for a long time and be comparatively unaffected by any of these influences. If of a suitable character, the gear lubricant may also be used on other parts than the gears, pinions and racks, such as trunnions, tracks, cables, chains and for coating the grooves of sheaves and drums. The saving from the use of such an all-round lubricant is briefly reported by one engineer as follows:

OCTOBER 15, 1917.

A call was made this morning at the plant of the Continental Portland Cement Company, Continental, Mo., for the purpose of inspecting the chains, gears and cables upon which Crater Compound had been previously supplied by the writer, and subsequently followed up by the operators.

The writer was pleased to find among the operators very enthusiastic boosters for Texaco Crater Compound which had been used on their gears, chains and cables. Previously they had been using on the large Marion Shovel chains, an average of 5 gallons of black oil per 12 hours running. This oil at 7 cents per gallon, is costing them an average of 35 cents per day, plus the necessity of frequent applications. The performance on the same shovel was 5 quarts of Crater Compound applied Wednesday morning, October 10. Upon examination on the 15th, a period of five days, the chains showed a very complete film over the entire surface and appeared as if it would be good for several days longer.

Cost of oil for five days	$1.75
Cost of Crater Compound for five days	.50
Saving	$1.25 or 71%

The results on the gears appeared to be something very unusual at this plant, as the one application made on these gears by the writer on the 8th still shows a very complete film over the bearing surface of all the teeth.

S. J. HUNT, Lubrication Engineer.

Gyratory Crushers consist of a heavy conical shell within which is located a vertical crushing head securely fastened to a shaft supported at the top by a spider. The bottom of the axis of the shaft is given a small circular motion by means of an eccentric supported by the bottom plate and operated by gearing, pulleys or ropes. If gears are used a bevel drive is usually installed with a counter-shaft on which is a pulley or a gear drive to the prime mover. Large quantities of fine broken rock fall on these bevel gears, particularly the gear driving the eccentric, and this will cut through almost any gear lubricant when crushed between the meshing teeth. The lubricant to be used on these gears, therefore, should be heavy enough to prevent, as far as possible, the cutting of the teeth by the rock dust, and fluid enough so that the dust will not form a paste to roll up and fall off the gear teeth leaving them bare. These gears never get very warm but frequently meet very severe cold weather and the lubricant manufacturer should bear this in mind and make the material so that it will not become brittle and flake off in zero weather.

Jaw Crushers are belt or rope driven and are not equipped with

any gears which require lubrication.

Rotary Screens for separating the coarser rock from the crushed material, are rotated by a girth gear or a large bevel gear at one end. All of the gears connected with the drive are naturally always covered with large quantities of dust and small bits of rock, and present a condition very similar to that of the crushers.

Rotary Dryers are rotated by girth gears driven through spur and bevel gears from a motor, line shaft or small steam engine. While these gears, like all other gears in a cement plant, are always covered with dust the gear lubricant is here subjected also to comparatively warm temperatures. The heat within the dryer keeps the girth gear pretty hot and the lubricant selected should have the ability to stick to the teeth without becoming so thin as to run off. This temperature condition, in most cases, requires the use of a heavy bodied lubricant having a higher liquefying point than a lubricant which would take care of the gears in the crusher house.

Ball Granulators used for wet and dry crushing consist of a steel cylinder supported on large bearings at either end and rotated by a large girth gear from a spur gear on a counter shaft. While the total dead weight of a ball mill, including the balls and the material, is considerable, the greater portion is carried by the bearings at the end and only a part of the weight of the balls is carried by the driving gears during rotation. The internal temperatures are never high, and the lubricating requirements are quite similar to those of any large medium speed gear, except for the ever present dust.

Kominuters for granulating are similar to ball mills in their lubricating requirements and may be lubricated with Texaco Crater Compound No. 1.

Tube Mills are used in both wet and dry grinding processes for medium and fine grinding before and after burning. The cylinder is rotated by means of a spur tooth girth gear and a simple train of spur gearing. The lubricating requirements are not unusual and the same gear lubricant that is used on the other crushing and grinding apparatus will be found very satisfactory.

Rotary Kilns for burning the pulverized mixture into cement clinkers present the most difficult lubricating conditions met with in the cement plant. The heat formed by the burning fuel penetrates the brick and heats the shell to a fairly high temperature. The girth gears which drive the kiln naturally become hot, in fact so hot as to very rapidly melt or thin down any lubricant unless it has been specially manufactured to meet these severe conditions. The cement dust collecting on the gears, together with the high temperature, rapidly dries out the oil from the ordinary lubricants and the gear teeth soon become dry and cut. The heavier grades of Texaco Crater Compound No. 2 and No. 5 will stick even under these extreme conditions, and will keep the gear lubricated with a minimum of attention. The same grades of gear lubricants may also be used for the remaining gears of the driving mechanism.

Clinker Coolers.—The hot clinker from the kilns must be cooled before it can be satisfactorily ground or pulverized and for this purpose rotating steel cylinders, very similar in appearance to the dryers and kilns, are used. While the girth gears of these coolers do not become as hot as those of the kilns they do,

nevertheless, require a lubricant which will withstand fairly warm temperatures without running off the gear teeth.

Crushing Rolls consist of two sets of rolls, one of which is driven by a pulley, the other being operated by a fixed roll which does not require a driving power. These rolls are seldom equipped with gears and, therefore, do not require a gear lubricant.

There are many types of pulverizers for the grinding of limestone, coal and cement clinkers used in the cement plant. These machines are seldom gear driven, being directly connected to electric motors or equipped with belts and ropes. The few types in use which are gear driven require a lubricant which will withstand the action of the dust which arises from the grinding process.

Elevators and Conveyors are usually gear driven, the greatest tax on the lubricant being the drying-up action of the dust; Texaco Crater Compound can be used with good results on such gears.

Slurry Pumps used in the wet process are frequently of the plunger type equipped with heavy driving gears. These gears are usually well made and may be lubricated with the same grade of gear lubricant used on other gears about the cement plant.

Summing up all of these conditions we may state briefly the characteristics which the gear lubricant must possess as follows:

The prime requisite is an ability to stick to the gear teeth and withstand the drying action of cement dust. It should be heavy enough to withstand the heaviest pressures encountered and prevent cutting of the gear teeth even when rock dust is collected. It should remain plastic during zero weather and not become brittle and crack or flake off; it should not cake with the cement dust or pack at the bottom of the spaces between the gear teeth. It should resist the highest temperatures existing on the kiln girth gears without excessive dripping and thinning down. It should, above all, be a good lubricant. A suitable lubricant will not require an application oftener than once or twice per twenty-four hours for any gears, with the possible exception of the dryers, kilns and coolers which may in some cases, necessitate more frequent applications, depending upon individual conditions.

Where the gears are not covered with gear guards and when the machinery may be shut down for short intervals, the lubricant may be heated and applied with a brush direct to the gear teeth, care having first been taken, however, to brush the cement dust off the gear teeth with a stiff wire brush. Those machines which are in continuous operation may be lubricated by heating the Crater Compound and pouring it onto the gears in a fine stream at the point of mesh, taking care that the gear lubricant strikes the working side of the gear teeth. This same method may be used where the gears are covered with gear guards if a hole is cut through the guard at the proper place. On all such gears it is important that Crater Compound be heated so as to thoroughly liquefy, being in this state in the best condition to facilitate close adhesion to the gear teeth. Where the gear guards or cases are oil tight the level should be maintained at such a point that the lowest tooth of the gear will be completely covered by the lubricant, and further applications will be necessary only when the level has been lowered through use to the point where the gear no longer dips.

Texaco Crater Compound No. 1 is used for all gears having bath lubrication, and exposed gears of steam shovels, crushers, ball mills, tube mills, rotary screens, elevators, kominuters and pulverizers while with Texaco Crater Compound No. 2 or No. 5 on the dryers, kilns and clinker coolers, the life of the gears will be greatly increased, the cost of maintenance and shut downs for repairs will be reduced and a general all around improvement in mechanical efficiency will be obtained.

SOUTHWESTERN PORTLAND CEMENT COMPANY.

El Paso, Tex., August 12, 1914.

Mr. A. F. Fegan,
c/o The Texas Company,
El Paso, Tex.

Dear Sir:

Confirming conversation with you regarding use of "Crater Compound" on our kiln gears, beg to say that for two years we tried to lubricate them with yours and other black oils without much success.

At that time, two years ago, you put in your "Crater" and I doubted the advisability of attempting to run the main girth gear any longer, but am pleased to say that the wear was stopped almost completely by the use of "Crater." The same gears are running today with promise of a long time yet. You can see the value of this, as this gear and pinion cost us about $600.00 without expense and loss of time in replacing.

Our gear lubrication on kilns and coolers was reduced in cost over 50% by use of "Crater" in addition to the above benefits.

Yours truly,

Southwestern Portland Cement Company.

By O. J. Binford,
Sec'y and Supt.

SOUTHWESTERN PORTLAND CEMENT COMPANY.

El Paso, Tex., Monday, Nov. 22, 1915.

Mr. A. F. Fegan,
c/o Texas Company,
El Paso, Texas.

Dear Sir:

Referring to your conversation in connection with photographs taken recently of our kilns, showing the Girth gear trains in operation, beg to state that in reference to our letter of August 12th of last year, that the life of these gears was prolonged in addition to the two years referred to in that letter, some six to eight months.

The new gears, we believe from past experience, lubricated with Crater Compound, should last four to five years, instead of about one to one and one-half years, with any lubrication we have been able to discover other than Crater Compound.

Yours truly,

Southwestern Portland Cement Company

By O. J. Binford,
Secy & Supt.

TEXACO THUBAN COMPOUND

REALIZING the importance of properly lubricating the transmissions and differentials of automobiles, and finding that there was no lubricant especially noted for its excellence for this particular service, The Texas Company found it advisable in the Fall of 1912 to conduct extensive experiments for the purpose of developing the best possible lubricant. These experiments and tests extended for many months and, as a result, in July 1913 Texaco Thuban Compound was placed on the market. Since this time its reputation has become national and it has been made the standard lubricant by many motor car and truck manufacturers for transsmisions and differentials.

As engineers became more familiar with this lubricant its use was extended to high speed power transmissions in mills and factories and then to worm drives, silent chains and many other types of power

transmission machinery. Before discussing the uses for which this lubricant is suitable it might be of interest to explain its physical characteristics and how they are affected by operating conditions.

Texaco Thuban Compound is a pure mineral lubricant of the highest quality, containing no fillers, graphite or thickeners, such as sawdust, mica, wood-pulp, asbestos, etc. At ordinary temperatures it is a liquid, becoming somewhat thinner when heated by running temperatures but holding its body to a remarkable degree. As is characteristic with all pure petroleum products it becomes heavier as temperatures decrease but does not become solid at any working temperature, remaining plastic and always a lubricant. Its body is much heavier than the steam cylinder oils which it is replacing for worm gear and high speed spur gear lubrication and is also more adhesive and does not drain from the gears when they are stopped. Thuban Compound has another natural advantage, in that it will better protect the metal on which it is used from corrosion or rust.

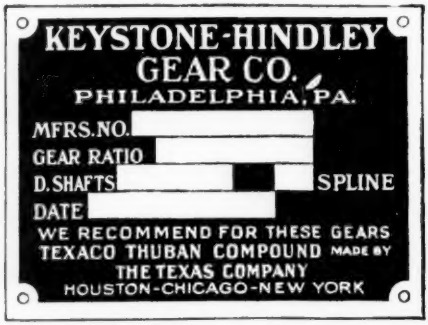
As Texaco Thuban Compound was originally developed for the lubrication of the transmissions and differentials of motor vehicles a discussion of the conditions met with in the lubrication of these parts and the way in which Thuban Compound meets them may be interesting. First of all, the lubricant must lubricate, and it must lubricate not only the gears but also the bearings contained within the gear case. These cases are, as a rule, made oil tight and enough lubricant is placed in the case to form a bath in which the gears revolve, continuously picking up the lubricant and splashing it to all of the parts. The right lubricant, therefore, must be sufficiently liquid to reach all of these parts and should not be so heavy as to stick to the sides of the gear case without returning to the bottom of the case for further use. It should be heavy enough to form a wear-resisting, noise-reducing film between the surfaces of the gear teeth. It should not get too thin in warm weather and should not get so heavy in cold weather that the transmission gear shaft cannot be operated, or so as to seriously increase the friction of the gears within the case. As practically all of the bearings in these gear cases are of the ball or roller type the lubricant must not be injurious to the highly polished surfaces of the bearings, rollers or racers.

All of the ball bearing manufacturers, who are naturally the best qualified to pass on what is suitable for ball bearings, have agreed that the lubricant should not contain free acid or any non-lubricating material or graphite; those lubricants which do contain these substances are not suitable. A comparison of the characteristics of Texaco Thuban Compound as outlined above will show at once how admirably adapted this lubricant is for this service.

A number of the leading motor car manufacturers have found Texaco Thuban Compound an excellent transmission and differential lubricant and are recommending its use.

The Hyatt Roller Bearing Co., also, whose product is well known throughout the automobile industry, have also found Thuban Compound suitable for the lubrication of roller bearings which are used in transmissions and differentials. Another concern identified with this industry is the Keystone-Hindley Gear Company who build worm drives for trucks. They are also recommending Texaco Thuban Compound and

attach to each gear case the metal plate shown below:



The next most important use for Texaco Thuban Compound is the lubrication of worm gears. The sliding action of the worm on the worm gear teeth, combined with the high speeds and high pressures which practically always exist, demand a lubricant of exceptional sticking qualities and high lubricating value. The kind of lubricant required depends upon the method of lubricating the worm. If the worm and gear are enclosed in an oil tight gear case permitting a bath, the lubricant should be sufficiently liquid to flow back to the center of the bottom of the case and constantly maintain the proper level. If a non-liquid lubricant is used, one that will throw off and stick to the sides of the case, the level of the lubricant will become so low that the worm will not dip and soon run dry. On the other hand, if light oils are used the pressure between the worm and worm gear will squeeze the film of lubricant out and cutting will take place. Texaco Thuban Compound strikes a happy medium and gives perfect results.

Worm drives, which are not enclosed in a bath, frequently require a heavier lubricant, one that will stick to the worm gear when once applied for a long enough time to prevent the necessity of frequent applications. On such constructions Texaco Crater Compound will give better results.

There are hundreds of uses of worm drives on all kinds of machinery and it would be almost impossible to enumerate the many places where Thuban Compound has been used. One field in which the worm drive has been widely used is that of the elevator, the lubrication of which is covered elsewhere in this magazine. The Whiting Foundry Equipment Co., are so well pleased with this lubricant in the worm drives of their elevators that they are attaching the metal plate shown below recommending its use.

Another use of Texaco Thuban Compound is the lubrication of the small gears in small overhead electric hoists. These gears are run at high speeds, the loads are light and the whole outfit is enclosed in an oil tight gear case. The Northern Engineering Works, Detroit, Mich., which has made a special study of lubrication of hoists of this type has issued the following instructions:

IMPORTANT

HAND THIS TO MAN IN CHARGE OF NORTHERN D-Q ELECTRIC HOIST

GEAR AND CABLE LUBRICATION

As per notation on metal plate located on front of gear

case, all gear teeth have been coated at the factory with Texaco Thuban Compound. This is a highly adhesive, protective lubricant, which will withstand the severe pressures encountered in gear drives. It is not affected by heat or moisture, and acts as a protection under dust conditions.

These qualities also make it suitable for wire cable lubrication, for, besides its ability to withstand pressures and resist attack from all sorts of exposure it will penetrate to the center of the rope and saturate the core, preventing the rotting of same. Texaco Thuban Compound is a purely mineral product and will not decompose to form a gum or other undesirable deposit. Its continued use on all gears and hoisting cables is recommended to insure minimum wear. A 5-pound can is shipped with the Hoist.

DIRECTIONS FOR USE

In the Gear Case—It is desirable that the level of the Texaco Thuban Compound in the gear case be kept about one-half inch below the armature shaft. This should require approximately four pounds of the product for the smaller size hoists, and five pounds for the larger sizes. The above level may stand a half inch lower and the gears still receive sufficient lubrication. It being necessary that the lowest teeth of the lowest gear be covered, however, the product should at no time be high enough to actually touch the armature shaft.

On Wire Ropes.—Texaco Thuban Compound is not as desirable for wire rope lubrication as another lubricant called Texaco Crater Compound, which is a heavier product. However, in lieu of the latter, the former may be used with very excellent results.

For application on wire ropes, it may be heated until very fluid and then poured in a fine stream on the rope while it is being wound on or off the drum. A more effective method, however, is to apply the fluid product to the rope when same is on the drum, using a short-bristled brush. Besides the rope, the drum and sheave grooves should receive a coating of the product in order to aid in distribution.

Once the product is established on the metal surfaces of the rope, the frequency of application will vary with service conditions from once per month to once or twice per year.

GENERAL NOTE

Unless the parts to be treated with Texaco Thuban Compound have already been coated with that product, all surfaces should be thoroughly cleaned with gasoline or kerosene, so as to remove all traces of any lubricant previously employed. Texaco Thuban Compound must reach the metal surface in order to produce the most efficient results.

NORTHERN ENGINEERING WORKS,
Detroit, Mich.

They know that the best results from any high grade machine cannot be secured unless the best of everything is used and they have taken this course to insure that the buyers of their hoists will always lubricate them with a suitable lubricant.

Machine tools, such as high speed

lathes, boring mills, drill presses, etc., which contain a number of small gears operating at high speed and contained within an enclosed gear case require a lubricant of just the right body to decrease the noise of operation and the friction due to the gears rotating through the lubricant. The use of a heavy grease in the gear cases of machines driven by comparatively small motors will seriously retard the speed of operation by the dragging action of the grease on the gears. On the other hand, a light machine oil, while it reduces this dragging action to a minimum, does not form a film on the gear teeth thick enough to prevent noise and wear. Texaco Thuban Compound should be in every machine shop for the lubrication of such gears accompanied by its big brother Texaco Crater Compound for the lubrication of exposed gears.

Some of the uses of Texaco Thuban Compound are—

Automobile and Truck Transmissions and Differentials,
Tractor Transmissions and Differentials,
Motor Boat Reverse Gears with separate Oiling System,
Enclosed High Speed Gears on Machine Tools of all kinds,
High Speed gear reducers,
Worm Gears Enclosed Bath Lubrication,
Elevator Worm Drives,
Stoker Worm Drives,
Electric Furnace Worm Drives,
Ball and Roller Thrust Bearings,
Slow Speed Radial Bearings and Roller Bearings,
Electric Hoists,
Worm Driven Rubber Machinery.

SAVE THE CASTOR OIL FOR THE GOVERNMENT DON'T USE IT FOR ELEVATORS

IN the *Oil and Drug Reporter* for June 10, 1918, the following statement appeared:

"WASHINGTON, June 8, 1918.

"With something like 110,000 acres of castor beans now being grown in the South under contract for the Government at a fixed price, the war-work authorities of the Government this week took the next step in providing an adequate supply of castor oil for the lubrication of the mighty fleet of airships now being built.

"After nearly three months of investigation, study and negotiations, carried on by cooperative efforts of the Signal Corps, the War Industries Board and the Bureau of Plant Industry, United States Department of Agriculture, a contract has been let for the establishment of a plant in the South at which it is proposed to crush all the castor beans grown for the Government in Florida and adjoining States."

This will give some idea of the importance attached to the production of Castor Oil by the United States Government and the extent to which they are going to insure an ample supply for aircraft motors. The United States needs every gallon of Castor Oil which is produced for the lubrication of certain types of aircraft motors for itself and the Allies, and every patriotic citizen who is using Castor Oil for any form of lubrication should immediately look about him and select the best possible substitute. There are many lubricants on the market for the various places on which Castor Oil has been used and it behooves the buyer to carefully investigate before making a selection.

Some of the largest users of Castor Oil for lubrication purposes are the operators of worm drive elevators, it having been used on these worms very extensively be-

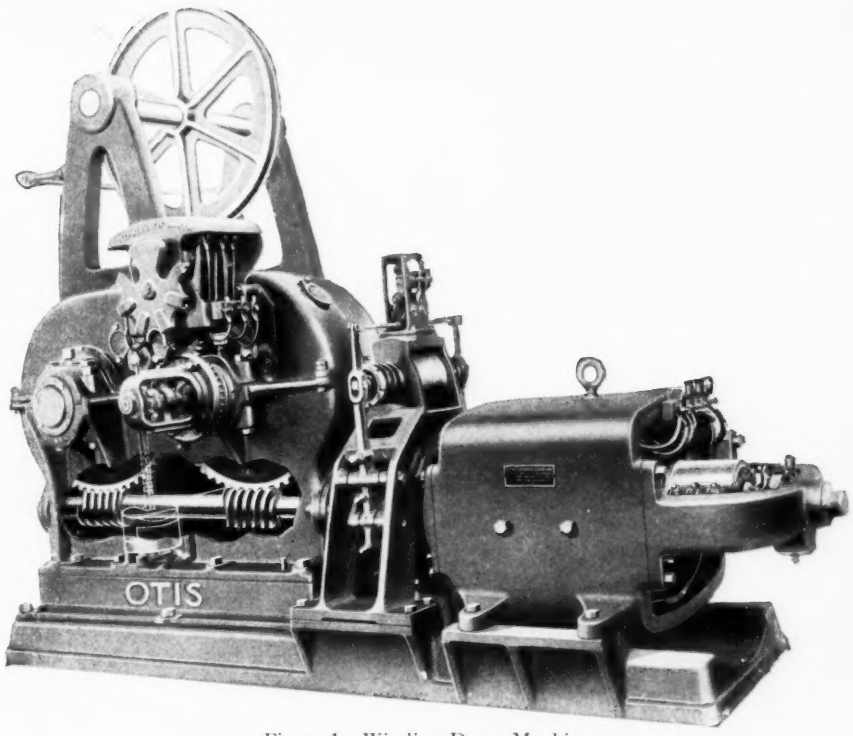


Figure 1—Winding Drum Machine

cause no other really high grade lubricant had been specially pushed by the oil refiners. Realizing this state of affairs, and foreseeing the demands for Castor Oil, The Texas Company some time ago investigated the mechanical construction and operating conditions of this type of elevators, with the view of determining the most suitable mineral lubricant.

While some elevators receive the proper care and attention, the majority of elevators, particularly those used for the handling of freight, are looked after at irregular intervals when there is nothing else of importance to do, and it is, therefore, necessary that everything pertaining to their operation be arranged so as to require as little attention as possible. As the smooth running of a worm drive elevator depends to a considerable extent upon the efficient lubrication of the worm and the gear, unless the lubricant used in the worm gear case is of the finest quality and possesses the characteristics which enable it to work for a long time frequently under warm temperatures, without deteriorating or drying up, the worm or gears will cut and fail to give satisfactory service.

The requirements for the worm gear lubricant may be stated briefly as follows:

1. Sufficiently heavy bodied to hold a film on the worm and gear to prevent cutting when the elevator is loaded to capacity and running at maximum speed.

2. Adhesive, so as to prevent the lubricating film being wiped off by

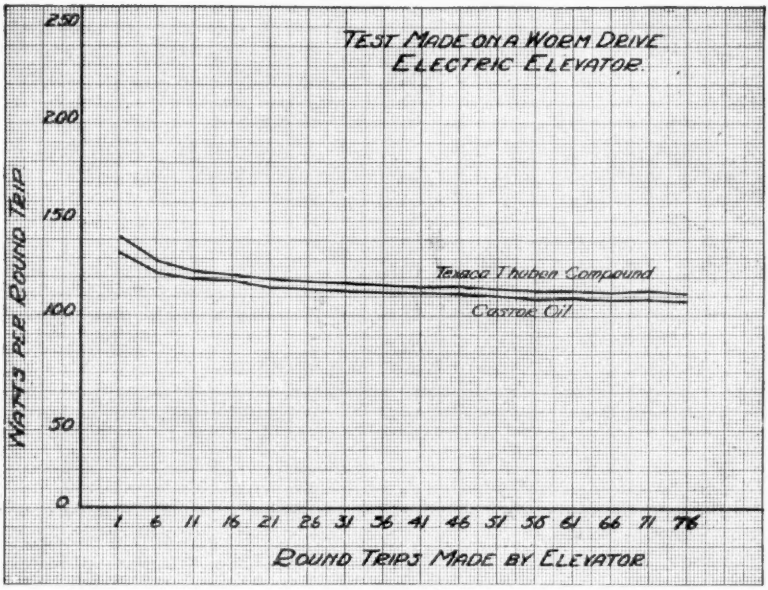


Figure 2

the sliding action of the worm and to prevent all the lubricant draining from the worm gear teeth when the elevator is standing idle, thus preventing rusting, if a steel gear is used, and providing lubrication when the elevator is again started.

3. Fluid at low temperatures, so that when the gear case is exposed to winter weather conditions, the lubricant will not become solid. If this occurs there is a possibility of damage to the thrust bearings from lack of lubrication, or a dragging action to the elevator because of the resistance of the solid mass to the rotation of the gear.

4. Too heavy a lubricant will cause a continual drag on the gears on account of excessive internal friction, with resultant high cost for electric power.

5. When the worm is enclosed in a gear case and an oil bath is provided, the worm thrust bearings also are lubricated with the worm gear lubricant. Because these bearings are ball, roller or thrust collars the lubricant should contain no substance which would damage these highly polished surfaces. Lubricants containing graphite, rosin, resinous oils, soapstone, wax, talc, powdered mica, lamp black, sulphur, asbestos, wood fibre or any similar artificial thickener are not suitable for these bearings, as is agreed by practically all manufacturers of ball and roller bearings.

6. Animal and vegetable oils in addition to being very expensive have a tendency to dry and gum and, with the exception of castor oil, have not been found to be as satisfactory as a proper mineral oil.

7. The worm spindle stuffing box is usually packed with square braided flax or hemp packing which the lubricant should keep soft and pliable. If the packing contains rubber, any petroleum lubricant used will slowly dissolve the rubber content, causing the packing to fall to pieces and leak.

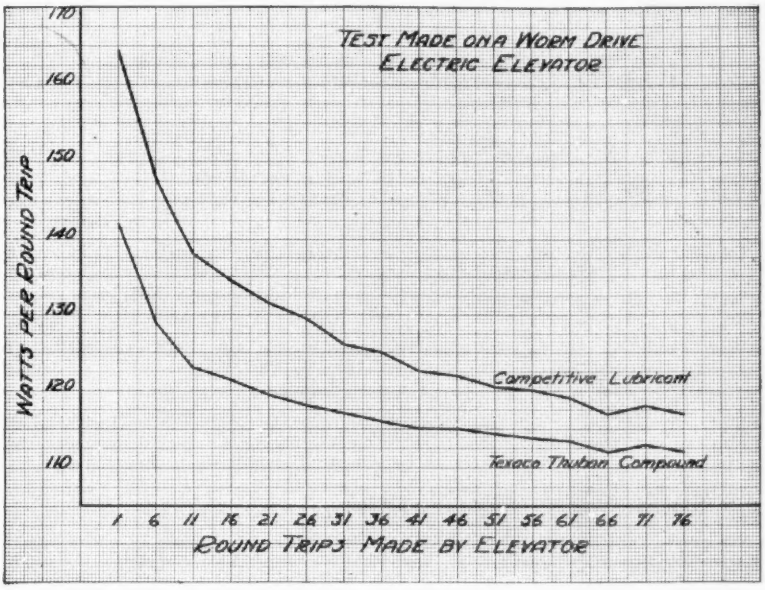


Figure 3

One of the most common complaints where some kinds of oils are used is that the lubricant is carried up by the worm gear and works out along the shaft to the drum. This does not cause any special trouble other than wasting the oil if the winding machine is at the bottom of the shaft, but if it is located at the top there is a possibility of a light bodied oil working out in sufficient quantities to drip down on freight or passengers. No building superintendent wants to receive a complaint that a passenger has had a new spring hat ruined. This can be prevented by using a lubricant of the right body and maintaining the oil level at about the center of the worm shaft. If the worm gear dips into the oil the teeth will carry up large quantities and cause the splashing referred to.

Having considered these requirements The Texas Company made a number of experiments and finally found that the best results of all were secured with the use of Texaco Thuban Compound. In fact, a test of this lubricant against a well known Castor Oil preparation in the worm drive of an electric passenger elevator showed that the lubricating qualities of these two products are practically equal. In fact, by referring to Figure 2 it can readily be seen that after the gear case had warmed up and a constant power consumption was secured Texaco Thuban Compound showed a consumption of only 5.4 watt hours per trip more than that required by the Castor Oil preparation, and based on an average of twenty trips per hour, operating ten hours per day, the total consumption would amount to only about one kilowatt more per day, or 5 cents per day. With Texaco Thuban Compound retailing in small lots at $2.00 per gallon, and Castor Oil at $3.28 in five gallon lots, one can readily see that the actual net saving in a year's time

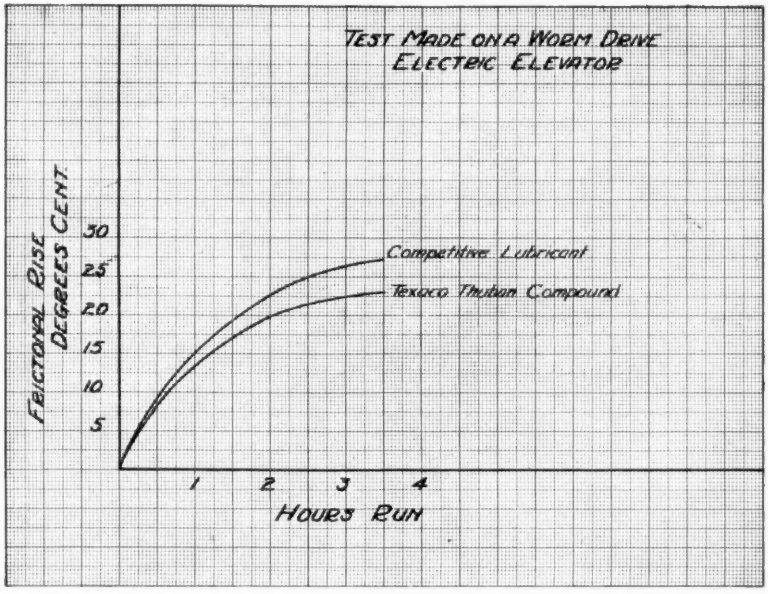


Figure 4

would be well worth while to any superintendent.

On the other hand, there have been many unsuccessful attempts made by other people to produce satisfactory substitutes for Castor Oil. It will be observed from a test of one of these, shown in the curves, Figure 3 and Figure 4, that the reductions in frictional temperature and in the power required are very favorable to Texaco Thuban Compound. The competitive lubricant used is a well known brand of graphite grease and the fact that it produced higher bearing temperatures would bear out the statement made above and concurred in by all the ball bearing manufacturers, that graphite greases are not suitable for ball bearing lubrication. The body of the graphite grease was less than that of Texaco Thuban Compound which would ordinarily tend to reduce the temperatures because of lower internal friction, but inasmuch as the temperatures were actually higher there is a very strong indication that the lubrication of the worm and gear was far from perfect.

A. D. ADAIR & McCARTHY BROS., INC.

ATLANTA, GEORGIA, Nov. 8, 1917.

MR. R. T. HANNA,
THE TEXAS COMPANY,
Atlanta, Georgia.

DEAR SIR:

Replying to your recent inquiry regarding your Thuban Compound, in our Otis Worm Geared Elevators, I beg to advise that I am more than pleased with its performance.

In my opinion it fills a long felt need for this purpose as it maintains its original body at all times and containing no compound therefore leaves no gum or residue in the cases, as experienced with all other lubricants I have used.

I might further add that it has entirely stopped all back lash that has always been noticeable and this fact proved to me that it will prolong the life of these gears considerably.

I consider Thuban Compound the best lubricant for this purpose I have found and can recommend it highly for worm gears.

Very truly yours,

Signed, H. F. McCOLLUM,
Chief Engineer, Walton Building.